



**2019 Water Quality Report**  
**Fresh Pond Reservation: Class B Ponds, Cambridge, MA**

The Cambridge Water Department monitors three ponds on the Fresh Pond Reservation: Little Fresh Pond, Black's Nook, and North Pond (figure 1). Water quality samples from each pond are collected quarterly. These shallow ponds have no surface water connections to the Fresh Pond water supply reservoir, and as such, they have negligible influence over water quality in the Cambridge water supply. Gated pipes between Little Fresh Pond and Fresh Pond Reservoir are kept closed under normal operating conditions but are opened as needed in controlled conditions to supply irrigation water to Little Fresh Pond. All three ponds drain the City of Cambridge Municipal Golf Course and the reservation's wooded areas, with overflow connections to the City's storm drain system. Stormwater in the developed areas surrounding the reservation is diverted away to further protect drinking water quality at Fresh Pond Reservoir. Groundwater communication between the ponds, the surrounding developed area, and the reservoir is minimized by keeping the reservoir elevation higher than the water table.



**Figure 1: Fresh Pond Reservation Waterbodies**



This report includes data from the reporting period of April 1, 2019 to March 31, 2020 (reporting year 2019).

Massachusetts Class B waters are designated for fish, other aquatic life and wildlife habitat, and for primary and secondary contact recreation. Class B water quality standards include numeric and narrative standards for dissolved oxygen, temperature, pH, bacteria, solids, color and turbidity, oil and grease, and taste and odor. In this study period, four dry-weather water quality sampling events were conducted. Samples were taken at the surface of each pond using extended poles or hand-grabbing samples after wading in from the shoreline. *In-situ* parameters were taken with a calibrated multi-probe concurrently with grab samples.

### 2019 Results

**Black's Nook**- Listed in the 2016 Massachusetts Integrated List of Waters as a Category 5 impaired water for transparency/clarity, nutrient/eutrophication biological indicators, and non-native aquatic plants. Although median and average TSI numbers during reporting year 2019 were in the mesotrophic range, the chlorophyll-*a* result from the 8/27/2019 sample corresponded to a TSI in the eutrophic range (figure 2). This indicates that productivity at the peak of the growing season was high at Blacks Nook, a finding supported by the overgrowth of plants in the pond (photograph A).

#### 1. Dissolved Oxygen (DO)

- Of the four surface DO measurements collected during the reporting period, one fell below the Class B standard ( $\geq 5$  mg/L). Respiration from microbial organic matter decomposition and algae and plant growth likely contributed to the low DO concentration during the 8/27/2019 summer sampling event.

Date	Time	Result
8/27/19	11:09 AM	4.5 mg/L

#### 2. Temperature

- No violations associated with warm-water fisheries were observed. The Class B standard requires temperatures not to exceed 28.3°C.

#### 3. pH

- No violations observed;  $6.5 < \text{pH} < 8.3$ .



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### 4. Bacteria

- No violations observed. All *E. coli* samples were less than the Class B single sample water quality standard (< 235 colonies/100mL or most probable number (MPN)/ 100 mL for a single sample).

### 5. Solids

- There are no numeric criteria for solids, but visual observations suggest that neither floating nor suspended solids were an impairment for Black's Nook. However, dense aquatic plant growth limited the potential for swimming and boating (photograph A).

### 6. Color and Turbidity

- There are no numeric criteria for color and turbidity. However, the standard dictates that water bodies must be free from aesthetically objectionable conditions. CWD did not observe visually objectionable color or turbidity during reporting year 2019.

### 7. Taste and Odor

- No objectionable odors observed.

### 8. Oil and Grease

- No samples taken, but no visible oil and grease sheens observed.

**Little Fresh Pond (LFP)**- Not assessed as part of the 2016 Massachusetts Integrated List of Waters survey. Chl-*a* results were consistent with Carlson's trophic state index of a highly-productive, eutrophic and hypereutrophic pond (figure 2). Shoreline restoration, vegetated buffers, and a pretreatment swale and forebay system were completed in 2008. Specific conductance readings and sodium and chloride concentrations are consistently among the highest of the reservation ponds (table 1). The values for these parameters closely mirror those of Fresh Pond Reservoir, reflecting the hydrological connectivity via pipes and groundwater communication.

### 1. Dissolved Oxygen (DO)

- All four DO measurements were above the Class B 5 mg/L DO minimum criterion.

### 2. Temperature

- No violations associated with warm-water fisheries were observed. The Class B standard requires temperatures not to exceed 28.3°C.



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### 3. pH

- No violations observed;  $6.5 < \text{pH} < 8.3$ .

### 4. Bacteria

- No violations observed. All *E. coli* samples were less than the Class B single sample water quality standard ( $< 235$  colonies/100mL or most probable number (MPN)/ 100 mL for a single sample).

### 5. Solids

- There are no numeric criteria for solids, but visual observations suggest that neither floating nor suspended solids were an impairment for LFP. However, the eutrophic state and corresponding aquatic plant growth may limit the potential for swimming and boating.

### 6. Color and Turbidity

- There are no numeric criteria for color and turbidity. However, the standard dictates water bodies must be free from aesthetically objectionable conditions. Aside from aquatic plant growth, CWD did not observe objectionable color or turbidity issues in the 2019 reporting year.

### 7. Taste and Odor

- No objectionable odors observed.

### 8. Oil and Grease

- No samples taken, but no visible oil and grease sheens observed.

**North Pond-** Not assessed as part of the 2016 Massachusetts Integrated List of Waters survey. During the growing season, this pond fills with floating and rooted aquatic plants. The 2019-2020 chl-*a* results were consistent with Carlson's TSI for a highly-productive, hypereutrophic pond (figure 2). North Pond had the highest average and median TSI readings in the reporting period and was the most eutrophic of the three ponds (figure 2). All four chl-*a* measurements collected in reporting year 2019 corresponded to a TSI in the hypereutrophic range.

### 1. Dissolved Oxygen (DO)

- Of the four measurements collected during the 2019 reporting year, DO was less than the 5 mg/L Class B standard during the November and February sampling events. The DO



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during the August sampling event was just above the Class B standard at 5.46 mg/L. Respiration of algae and plants could account for the low DO. Although low DO is less common in late fall and winter since cold water can hold more DO than warm water and microbial respiration tends to slow down, the low DO could reflect the high organic matter load and microbial respiration during decomposition. In February, CWD broke through a thin layer of ice into turbid water to collect the sample. The ice may have restricted oxygen from the atmosphere from mixing with the water.

Date	Time	Result
11/7/2019	10:44 AM	2.19 mg/L
2/4/2020	12:31 PM	2.63 mg/L

### 2. Temperature

- No violations associated with warm-water fisheries were observed; temperature remained below 28.3 degrees C.

### 3. pH

- No violations observed; all laboratory pH readings  $6.5 < \text{pH} < 8.3$ .

### 4. Bacteria

- One sample exceeded the Class B *E. coli* single sample standard of 235 colonies/100 ml.

Date	Time	Result
6/4/2019	10:29 AM	260.3 MPN

### 5. Solids

- There are no numeric standards for solids. Visual observations suggest that neither floating nor suspended solids were a source of impairment for the pond, except for the excessive vegetation and turbidity during the summer months discussed below.

### 6. Color and Turbidity

- The eutrophic state and water clarity discourage swimming and boating; during the summer, North Pond becomes choked with aquatic vegetation and suspended organic



matter. During the February sampling event, the water and ice were visibly turbid (photograph B).

7. Taste and Odor

- During the 11/7/2019 sampling event, CWD staff reported an unusual odor that smelled like hay or a barn.

8. Oil and Grease

- No samples taken, but no visible sheens observed.

**Photograph A: Blacks Nook, view looking northwest, showing dense macrophyte growth, on 8/15/2019.**



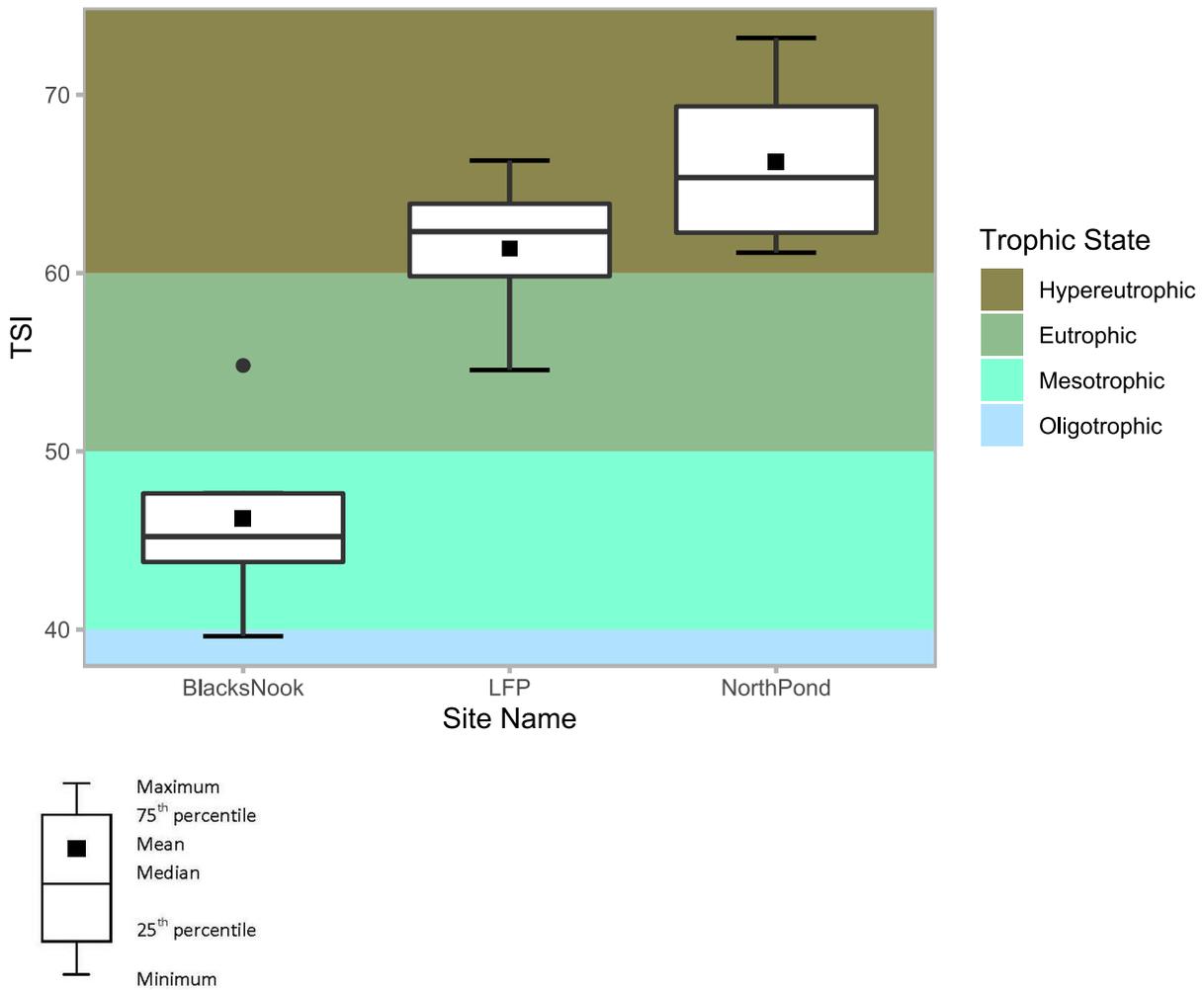


**Photograph B: North Pond looking southwest, 2/4/2020. Water and ~1/8" ice cover, water visibly brown and turbid.**





**Figure 2: Reservation Pond Trophic State Index from Chlorophyll-*a*, April 1, 2019 – March 31, 2020**





**Table 1: Water Quality Results**

Date	Site	Alkalinity (mg CaCO <sub>3</sub> /L)	Al (mg/L)	Ca (mg/L)	Cl (mg/L)	Chl- <i>a</i> (mg/m <sup>3</sup> )	Color (CU)	DO (mg/L)	<i>E. coli</i> (MPN/100 mL)	Fe (mg/L)	Lab pH	<i>In situ</i> probe pH	Mn (mg/L)	Na (mg/L)
6/4/2019	BlacksNook	46	0.01	15.6	13.5	2.51	20	8.87	19	0.47	7.01	7.53	0.038	7
6/4/2019	LFP	46	0.09	24.4	110	27.4	57	8.95	27	0.88	7.34	8.13	0.165	71
6/4/2019	NorthPond	122	0.01	46.6	20.1	45.6	78	7.67	260.3	2.33	7.06	7.17	0.288	14
8/27/2019	BlacksNook	44	0.11	13	8.33	11.8	41	4.5	11	1.64	6.64	6.71	0.202	7
8/27/2019	LFP	51.5	0.16	29.7	99.5	38.1	48	6.77	139	11.2	6.89	7.14	0.341	72
8/27/2019	NorthPond	100	0.01	31.1	12.1	26.2	66	5.46	68	2.19	7.15	7.12	0.225	11
11/7/2019	BlacksNook	46	0.02	17.2	15.1	4.45	18	5.87	11	0.38	6.9	7.17	0.026	6
11/7/2019	LFP	42	0.04	18.5	84	23.5	35	8.22	32	0.72	6.92	7.41	0.106	54
11/7/2019	NorthPond	84.5	0.02	28.1	17.6	22.5	78	2.19	10	2.4	7.02	7.08	1.27	10
2/4/2020	BlacksNook	45.5	0.04	13.2	14.4	4.42	21	10.94	<1	0.58	7.03	7.61	0.049	8
2/4/2020	LFP	46	0.01	20.1	104	11.5	22	12.83	1	0.37	7.25	7.97	0.068	63
2/4/2020	NorthPond	122	0.05	40.2	21.9	76.8	196	2.63	<1	9.04	6.83	7.26	0.997	11



**Table 1: Water Quality Results cont.**

Date	Site	NH <sub>3</sub> -N (mg/L)	NO <sub>3</sub> -N (mg/L)	Lab SpC (uS/cm)	<i>In situ</i> probe SpC (uS/cm)	Total Dissolved Solids (mg/L)	Water Temperature (degrees C)	TKN (mg/L)	Total Organic Carbon (mg/L)	Total Phosphorus (mg/L)	Turbidity (NTU)
6/4/2019	Blacks Nook	0.108	< 0.05	131	142.5	91.2	19.71	0.46	5	0.0266	1.49
6/4/2019	LFP	0.24	0.134	463	539.2	345.1	20	0.772	5.6	0.0425	7.24
6/4/2019	North Pond	0.211	< 0.05	288	323.7	207.1	20.11	1.04	12.7	0.0648	9.5
8/27/2019	Blacks Nook	0.0764	< 0.05	121	128.1	82	19.86	0.588	5.1	0.0584	3.01
8/27/2019	LFP	0.125	< 0.05	430	491	314.2	22.84	0.761	6.1	0.0383	5.78
8/27/2019	North Pond	0.225	< 0.05	237	256.8	164.3	21.19	0.901	12	0.0351	6.48
11/7/2019	Blacks Nook	0.0539	< 0.05	118	139.3	89.2	9.29	0.399	4.1	0.0425	1.55
11/7/2019	LFP	0.192	0.0614	349	383.6	245.5	9.69	0.776	5	0.118	3.86
11/7/2019	North Pond	0.167	< 0.05	206	227.4	145.5	7.85	0.857	11	0.0744	4.22
2/4/2020	Blacks Nook	0.107	< 0.01	118	109.6	n/s	3.81	0.36	4.1	0.0276	2.15
2/4/2020	LFP	0.305	0.22	423	361.4	n/s	4.22	0.736	3.9	0.0276	2.2
2/4/2020	North Pond	0.214	< 0.01	268	243.5	n/s	3.63	1.99	12.8	0.152	29.3
n/s = not sampled or measured											